Hypernatremia and excessive weight loss in exclusively breastfed term infants in early neonatal period

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ABSTRACT

Introduction: Newborn infants lose weight in the first week of life. There is an increasing recognition of hypernatremia and it's complications in exclusively breastfed newborns. Early recognition of critical weight loss, signs, and symptoms of dehydration and hypernatremia are keys to prevent morbidity and mortality in these neonates. **Objectives:** To identify term neonates with excessive weight loss >10% of birth weight and to compare their serum sodium levels with levels in babies with weight loss <10% of birth weight. **Materials and Methods:** A prospective observational study was conducted on healthy full-term exclusively breastfed newborns delivered in a rural tertiary hospital. The primary outcome was the proportion of newborn infants with loss >10% of birth weight at day 5 and serum sodium levels in these babies. **Results:** Weight loss >10% of the birth weight was seen in 6.22% of term babies. The mean weight loss in this group was 360.14±81.82 g in comparison to 141.32±67.78 g in rest of the babies. Serum sodium >149 meq/L was seen in three neonates in excess weight loss group, i.e., 1.33% of neonates in the study. The mean serum sodium was higher in babies with excess weight loss (141.71±4.39 vs. 139.74±2.32 mEq/L, p=0.0045). **Conclusion:** About 6.22% of exclusively breastfed term neonates had excessive weight loss and serum sodium levels were higher in these babies with than those with weight loss <10% of birth weight. Neonates with excessive weight loss need more cautious follow-up for early recognition of potential hypernatremia and its complications.

Key words: *Exclusive breastfeeding, Hypernatremia, Neonates*

Breastfeeding is indeed considered the "best feeding" practice of newborns in both developing and developed countries. It optimally meets the nutritional and immunological needs of the newborn and helps to develop emotional bonding between mothers and neonates. Physiological weight loss of 5-10% is seen in full-term neonates, which is mainly due to loss of extracellular fluid. The volume of breast milk in first few days is low, during which there is a fall in weight and increase in serum sodium. Neonates begin to gain weight and their serum sodium levels fall when mature milk is copiously produced. Birth weight is regained by the age of 8.3 days on an average in term breastfed newborns [1,2]. In the past, feeding babies artificial feeds with very high sodium was the cause of hypernatremia [3]. There is an increasing recognition of hypernatremic dehydration and excessive weight loss in exclusively breastfed newborns [4-6]. While malnutrition with critical weight loss is implicated as a major cause of severe hypernatremia [7], elevated breast milk sodium has also been demonstrated as a rare albeit missed cause [8,9]. The condition is often unrecognized or misdiagnosed as sepsis due to a variable and nonspecific presentation. Timely recognition of babies with excess weight loss and appropriate intervention may prevent complications associated with hypernatremia. This study was undertaken to identify term babies with excess weight loss and study their serum sodium levels and compare with babies having physiological weight loss.

MATERIALS AND METHODS

A prospective observational study conducted in a tertiary level rural hospital, MVJ Medical College and Research Center, over a period of 4-month from April to July 2012. Clearance was obtained from the institutional ethical committee. Inclusion criteria were healthy, term, singleton neonates with birth weight >2,500 g and an uneventful perinatal period. Babies with congenital malformations, abnormal neonatal adaptation, the need for neonatal intensive care unit care, and those requiring phototherapy for neonatal jaundice were excluded from the study. 245 healthy term newborns who were exclusively breastfed were included in the study. Breastfeeding was initiated within 1 h of delivery, and the neonates were roomed in and bedded in with their mothers. All mothers were given unstructured verbal advice by the postnatal ward nurses and doctors about exclusive breastfeeding and its benefits. Adequate support and supervision of the mothers to exclusively breastfeed

their neonates were given. Informed consent was obtained from parents of neonates included in the study.

The babies' weight was recorded at birth, and then daily till discharge and on day 5 using electronic weighing scale (Phoenix Model Bws 101). 162 babies were weighed and sampled as in-patients. 83 babies who were discharged at 72-96 h of life were called back for weighing and sampling, of whom 20 babies did not return on the designated day. 225 babies were thus sampled on day 5 for thyroid screening during which their serum sodium levels were also estimated. All the babies were weighed using the same electronic weighing scale in the postnatal ward.

The primary outcome was the identification of babies with excess weight loss (>10% of birth weight), and their serum sodium levels which were compared with babies having physiological weight loss (<10% of birth weight). Secondary outcomes measured were the frequency of breastfeeding per day and number of times stools passed per day in the two groups.

Statistical analysis: SPSS version 21 was used. Variables were analyzed using unpaired Student's t-test and χ^2 test. $p<0.05$ were considered significant.

RESULTS

Of the 225 neonates in the study, 106 (47.11%) were males and 119 (52.89%) were females. The characteristics of the neonates included in the study are summarized in Table 1. 14 neonates (6.22%) in the study showed excess weight loss >10% of birth weight. 131 babies (58.22%) and 80 babies (35.56%) showed weight loss 5-10% and <5%, respectively.

Of the 14 neonates with excessive weight loss, 3 babies had serum sodium ≥149 mEq/L, i.e., 1.33% of neonates included in the study. These three neonates were asymptomatic and managed by increased frequency of breastfeeding after their serum sodium levels were known. The mean birth weight of the babies in physiological and excess weight loss groups was 2962.65±395.54 and 2845.71±394.02 g, respectively. 7.87% and 4.08% of babies born to primiparous and multiparous mothers showed excess weight loss, respectively (p=0.0887). 11.43% of babies delivered by lower segment cesarean section (LSCS) showed excess weight loss against 3.87% of those delivered by normal vaginal route (p=0.0301).

The comparison of variables between babies with excess and physiological weight loss is shown in Table 2. The mean weight loss was 360.14±81.82 g and 141.32±67.78 g in two groups (p<0.0001). Mean serum sodium was 141.71±4.39 and 139.74±2.32 mEq/L, respectively, in two groups (p=0.0045). The frequency of breastfeeding (number of times per 24 h) was 7.57 times/day in the excess weight loss group versus 8.61 times/day in another group (p=0.0224). 6 out of 14 babies (42.86%) passed stools <4 times per day in the former group in comparison to 18.96% in latter group (p=0.032).

Table 1: Characteristics of the neonates in the study (total 225)

Variables	N (%)
Birth weight (g)	
2500-3000	121 (53.78)
3001-4000	104 (46.22)
Males	106 (47.11)
Females	119 (52.69)
Vaginal delivery	155 (68.89)
Cesarean section	70 (31.11)
Primipara	127 (56.44)
Multipara	98 (43.56)

Table 2: Comparison of neonates with weight loss<10% of birth weight and those with>10% weight loss

Variables	n=211 (<10% weight loss)	n=14 (>10% weight loss)	p value
Weight (g) Mean±SD	141.32±67.78	360.14±81.82	<0.0001
S. sodium (mEq/L) Mean±SD	139.74±2.32	141.71±4.39	0.0045
Stools<4 times/day n (%)	6 (42.86)	40 (18.96)	0.032
Breast feeds/day Mean±SD	8.51±1.48	7.57±1.55	0.0224

SD: Standard deviation

DISCUSSION

Early and exclusive breastfeeding is the safest method of feeding neonates. However, significant weight loss and hypernatremic dehydration with its severe complications may occur due to inadequate breastfeeding. The output of breast milk increases from <100 ml/day on postnatal day 1 to about 500 ml/day by day 4 with the onset of copious milk production in lactogenesis stage 2 [10,11]. The majority of babies (58.22%) in this study showed weight loss between 5% and 10% of birth weight while only 6.22% showed excess weight loss >10%. This group also showed higher mean serum sodium levels in comparison with those with physiological weight loss. Caglar et al. reported in 2006, that 33.3% of babies with >10% weight loss had hypernatremia ranging between 151 and 168 mmol/L [12]. In our study, 3 of 14 (21.49%) neonates with weight loss >10% of birth weight had serum sodium ≥149 meq/L. Laing and Wong emphasized the need to identify babies with >10% loss of birth weight, estimation of serum sodium in these babies and admission of those with >149 mmol/L for further care. Weight loss >10% and serum sodium >149 meq/L should be perceived as warning signs to initiate remedial action [13].

In this study, 42.86% of babies with excess weight loss passed <4 stools/day compared to 18.96% babies in the other group (p=0.032). Caglar et al. too reported that babies with weight loss >10% were more likely to pass less than four stools per day. Also in this study, the frequency of breastfeeding in babies with excess weight loss group was 7.51 times/day, lesser than 8.51 times/day in the other group (p=0.0224).

About 3 cases of severe hypernatremic dehydration with clinical features of sodium load and complications have been described by Bajpai et al. in 2001. Paul et al. in 2000 reported

similar cases of malnutrition and hypernatremic dehydration in breastfed babies presenting in the third week of life. Markedly elevated breast milk sodium was noted in both studies [6,8]. Krishnamurthy et al. reported hypernatremic dehydration in 2 exclusively breastfed neonates presenting with severe dehydration in the first week of life, unlike that typically encountered between first and third weeks of life [9].

Laing and Wong reported an increasing incidence of hypernatremic dehydration in recent times. They suggested that in breastfed infants, hypernatremic dehydration has always been a problem, but was under-reported and had inadequate exposure in medical literature. They recommended that audit should be done to identify babies with >10% loss of birth weight and a strict definition of the condition should be agreed upon [13]. In a retrospective study in 2005, Moritz et al. published that 1.9% of hospitalized term and near-term infants had hypernatremic dehydration, with hypernatremia of moderate severity (median: 153 meq/L; range: 150-177 mEq/L) and 13.7% mean weight loss. They laid emphasis on increased efforts to establish successful breastfeeding [14]. Koklu et al. reported 2.1% incidence of breastfeeding associated hypernatremic dehydration in hospitalized terms and near-term infants in Turkey. They also reported abnormal development at 12 months of age in more than half of infants admitted with breastfeeding associated hypernatremia [15].

In this study, 7.87% of babies born to primipara had excessive weight loss compared to 4.08% of those born to multiparas. The difference, however, was not statistically significant (p=0.0887). When babies with excessive weight loss from vaginal delivery were compared with those from LSCS, there was a significant difference (p=0.0301). Jain S reported that in exclusively breastfed term and near-term infants, mean day of presentation of neonatal hypernatremic dehydration was 5.30±2.33 with a mean serum sodium of 153.50±9.78 meq/L and those born to primiparous mothers presented with more weight loss and hypernatremia. In their study, they noted that hypernatremia was more in babies born to cesarean section mothers. They also reported that clinical symptoms of hypernatremic dehydration were the same in summers and winters while a significantly greater weight loss was seen in summer months [16].

The limitation of this study is the small number of subjects included. The study was conducted in summer months which may add to the excess weight loss due to high ambient temperature.

CONCLUSION

Breastfeeding has undoubted health advantages for both the newborns and mothers and exclusive breastfeeding for first six months of life has to be promoted. However, the potential for excessive weight loss (>10% of birth weight) and hypernatremia with its complications should also be considered. Babies should be weighed before discharge and those with weight loss >10% of birth weight should be followed up vigilantly for further weight loss along with serum sodium levels. Early identification of such babies, support for mothers and correction of breastfeeding techniques may help prevent the complications of hypernatremic dehydration.

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